Claims:

1. A hydraulic machine which can exchange hydraulic fluid pressure with rotational motion of an output means, the hydraulic machine having a radial arrangement of a plurality of piston and cylinder assemblies about at least one crankshaft coupled to the output means, the cylinder and piston assemblies being longitudinally spaced along the crankshaft; and means for varying the eccentricity of the crankshaft.

2. The hydraulic machine according to claim 1 wherein each piston is connected to the crankshaft by a connecting rod with a spherical bearing disposed between the countershaft and the connecting end.

3. The hydraulic machine according to either claim 1 or 2 wherein the means of varying the eccentricity of the crankshaft causes the stroke length of the pistons to be varied between zero and the maximum length of the stroke.

4. The hydraulic machine according to claim 3 wherein the means for varying the eccentricity of the crankshaft is located at each end of the crankshaft and includes:

an inner cylinder with a hollow eccentric cylindrical core within which the respective crankshaft is received such that the longitudinal axes of the inner cylinder and crankshaft are parallel and offset;

an outer cylinder with a hollow eccentric cylindrical core within which the inner cylinder is received such that longitudinal axes of the outer cylinder and inner cylinder are parallel and offset;

a cylindrical main bearing with a concentric hollow cylindrical core within which the outer cylinder is received; and

a drive means, wherein the drive means can be operated to simultaneously rotate the outer and inner

cylinders to change the distance between the longitudinal axes of the main bearing and the crankshaft at both ends of the respective crankshaft.

5. The hydraulic machine according to claim 4 wherein the drive means includes, at each end of the crankshaft:

a ring gear with teeth on both the inner and outer surfaces of the ring;

a set of teeth around an end portion of each of the inner and outer cylinders; and

a gear train to transfer rotation from the ring gear to the inner and outer cylinders, wherein the ring gear is supported by the respective main bearing, and the main bearing has a cut out portion through which the gear train extends to engage the ring gear.

6. The hydraulic machine according to claim 5 wherein the main bearings have teeth on the outer surface, and the ring gears are disposed next to the teeth on the respective main bearing, and the drive means further includes:

a shaft with a helix formed on the shaft surface and pinion gears which engage the teeth on each of the main bearings such that the shaft rotates with the main bearings;

at least one nut with an internal helix which engages the helix on the shaft and at least one projection which is radial with respect to the shaft;

at least one hollow cylindrical outer sheath through which the shaft extends, the at least one sheath having two thin pinning gears at each end of the outer sheath, wherein each thin pinion gear engages a ring gear of the drive means, the at least one outer sheath having at least one longitudinal slot through which the at least one projection extends.

7. The hydraulic machine according to claim 6 wherein

the drive means is operated by moving the nut longitudinally along the shaft, and the outer sheath can be rotated with respect to the shaft.

8. The hydraulic machine according to claim 7 wherein moving the nut longitudinally advances or retards the ring gears with respect to the main bearing.

9. The hydraulic machine according to claim 8 wherein both the inner and outer cylinders have a counter weight.

10. The hydraulic machine according to any one of the preceding claims including at least one lay shaft having, for each of the main bearings, a pinion gear to engage the teeth on the respective main bearing, whereby the torque applied to each of the main bearings is transferred through the at least one lay shaft rather than being transferred to the crankshaft.

11. The hydraulic machine according to any one of the preceding claims wherein the hydraulic cylinder and piston assemblies are supported by the housing such that the hydraulic piston cylinder assemblies can oscillate as the respective crankshaft rotates.

12. The hydraulic machine according to claim 11 wherein the head of each hydraulic piston and cylinder assembly is supported between a pair of thrust blocks which are supported by the housing.

13. The hydraulic machine according to claim 12 wherein the heads of the hydraulic piston cylinder assemblies have, at least partially, a spherical shape.

14. The hydraulic machine according to claim 13 wherein each pair of thrust blocks has a complementary shape to the heads of the hydraulic cylinders.

15. The hydraulic machine according to any one of the preceding claims wherein the hydraulic cylinder and piston assemblies are attached to the crankshaft with the same angle therebetween.

16. The hydraulic machine according to any one of the preceding claims wherein there are five hydraulic cylinder and piston assemblies disposed at 72° intervals about the crankshaft.